

Ken-A-Vision Mfg. Co. Inc.

**Glossary of Terms used in
Product
Specification Sheets
for
Cameras and Microscopes**

Abbe Condenser (see Condenser)

Achromat Lens (see lens)

Adapter –

See Power Supply – note all digital-only cameras (microscope or flexible-necked camera are powered by the USB connection.

Eyepiece Adapter – For attaching Ken-A-Vision Cameras with a microscope – accessory supplied with all KAV cameras, which allow our cameras to be closely aligned with the eyepiece of the microscope.

Analog Output – (see also Composite Video). Analog signals are continuous electrical signals that vary over time. Usually the variations follow that of the non-electric (original) signal. So, for example, a telephone signal is analog, and the variations in the wave form signal are the same as the original voice of the speaker into the phone. Therefore, the two are analogous hence the name analog. Compare this to a Digital output. (See Digital Output)

Anisotropic materials – (see Materials – anisotropic)

Apertures (openings in microscope Diaphragm) – (see Diaphragm)

Applied Vision™ for Windows – (see also Software) – Ken-A-Vision's own software (Version 3.0 available Spring, 2007) which works seamlessly with Ken-A-Vision digital USB products. It allows for the capture of single images, time-lapse sequences, time-lapse movies, and movies. Advanced functionalities such as image amalgamation, measurement, and image marking are also available. Images are exportable to Word, WordPerfect, Power Point and other equivalent presentation programs.

AVI - Audio-Video Interleave – is the video format for Windows and the format in which time-lapse movies or digital movies are saved when using Applied Vision™ for Windows.

Audio Output – Some KAV Products have built-in microphones or the ability to have microphones plugged in using an RCA Jack. (see also Connectors)

Auto Focus- the ability of a camera to attain the correct focus on a subject, instead of requiring the operator to adjust focus manually.

Ball and socket – attachment for head of some Ken-A-Vision cameras– literally a ball, which rotates in a socket allows camera head to be maneuvered over a 90° range of motion.

Binocular Head – (see Head-binocular)

Blooming – This is an image artifact that can affect the quality of the image (**Smear** is another artifact – see below)). Blooming is an overflow of photodiode charge into neighboring pixels. It can occur when trying to image a very bright spot. It results in a distorted image but can be avoided by using correct lighting,

Box Dimension – Dimensions of the packaging carton in which a KAV item is shipped, expressed in inches and centimeters (international).

Box (Boxed) Weight – Weight of item for shipment, includes both the weight of the product and the shipping materials.

Bright/Dark Switches – On 7300 and 7600 Video Flex cameras and MVP products, a button in the base which allows the user to brighten or darken the picture being displayed by the camera. This adjustment is also possible using the Applied Vision™ for Windows software. See also Brightness.

Brightness – The quality or condition of being bright; the luminous quality of a color (as distinct for hue) by which it is regarded as approaching the maximum luminosity of pure white or the lack of luminosity of pure black. Brightness control, is more properly called black level. It adds or subtracts an offset, or bias, into the red, green, and blue signals. This control should be adjusted so that black picture content displays as true black on your monitor. Mis-adjustment of this control is the most common problem of poor quality picture reproduction on computer monitors, video monitors, and television sets. The setting is somewhat dependent upon ambient light. Brightness may be adjusted on all Ken-A-Vision products using Applied Vision™ for Windows. Some camera units have a button in the base of the unit for adjustment of brightness.

Auto Brightness - is a feature of some cameras that allows them to obtain the correct white balance, on a subject, instead of requiring the operator to adjust white balance manually.

Brightness Compensation – same as Auto Brightness.

Manual Brightness - Ability of the user to change the brightness or darkness of a displayed image overriding any preset (default settings).

C-Mount lens - a type of lens mount commonly found on movie cameras, television cameras, and trinocular microscope phototubes. The C-mount lenses typically provide a male thread which mates with a female thread on the camera. [The thread is nominally 1 inch in diameter, with 32 threads per inch, designated as "1-32 UN 2A" in the ANSI B1.1 standard for unified screw threads. The register (distance from the lens mount flange to the focal plane) is 17.526 mm (0.69 inches) for a C-mount, 12.52 mm for the otherwise identical CS-mount]. The letter "C" is said to stand for "cine", the original application being movie camera lenses.

Cable – KAV supplies various cables with its products. These include USB cables (usually 5 ft. - 1.5 m.), Composite (12 ft.- 3.6 m.), S-video (12 ft-3.6 m).

Cable length – (see Cable)

Cat. 5 Cable – (see connectors)

CCD Camera - a **C**harge-**C**oupled **D**evice. The specific technical detail is that in a **CCD** sensor, every pixel's charge is transferred through a very limited number (often one) of output nodes to be converted to voltage, buffered, and sent off-chip as an analog (video) signal. All of the pixel can be devoted to light capture, and the uniformity of the output (a key factor in image quality) is high. KAV Video (analog) cameras and also cameras capable of outputting both Analog and Digital signals simultaneously, will use a CCD camera.

Ceiling mount – (Tile Support Rail) - Provided with the Ceiling DocCam II to allow installation of this camera between the tiles in a standard drop (suspended) ceiling [2' x 2' (0.6m x 0.6m) tiles or 2' x 4' (0.6m x 1.2m) tiles]. It is designed to be installed at heights between 8' and 12' (2.44 m to 3.66m). The main support is a metal plate [8.5" x 24" (21.59 x 60.96 cm)] which distributes the weight of the camera on the support rail grid, preventing tile warping. A Plenum-rated enclosure for the camera attaches to this metal plate, and allows the camera to hang between two ceiling support rails.

Charger - (microscopes and cameras) – (see power supply)

Chrominance - Portion of video signal that carries hue and saturation color information. (see also luminance).

Coarse/Fine Adjust – On microscopes Coarse and Fine Adjustment knob(s) are located on the side of the microscope frame, usually below the stage, which allow the observer to adjust the focus of the microscope. There are various kinds of coarse and fine adjust mechanisms.

Coaxial Controls – Consists of two knobs where one smaller knob (fine adjust) is centered on top of another, larger knob (coarse adjust), both on the same axle.

Singlet Control – one knob does both coarse and fine adjustment. Excellent for novice and young microscope users. Only the 1100, 1180, 1200, 1201, and 1252 have a single knob, which operates a rack and pinion gear set.

Rack and Pinion – refers to the interlocking of a series of gears and cams that allows the coarse and fine adjustment knobs to interact. Most Ken-A-Vision microscopes have a rack and pinion system except the ESH 200,

Planetary - Coaxial coarse and fine focusing, with planetary reduction gear system, is a more advanced version of the basic rack and pinion system. This is found on the 1900, 2700, 2800 and 3300 series compound microscopes.

Coaxial Controls – (see coarse/fine adjust)

Composite Video - composite Video signal combines luminance and chrominance in a single signal. Differentiated from S-Video, where the two signals (brightness and color) are carried separately.

Compression - The digital representation of media in an efficient storage format. For video, motion-JPEG is often used. Compression may produce a poor quality image, in that the original picture cannot be reconstructed exactly.

Condenser (Microscopes) - a lens or lens system located either within or below the stage, which helps to focus the light coming into the specimen from the microscope's light source. All Ken-A-Vision compound microscopes (have at least a single lens located within the opening of the stage.

Standard – glass lens focusing light from illuminator in base of microscope.

Abbe - a moveable lens system under the stage (sub-stage) that can be moved up and down vertically, regulating the amount of light from the illuminator (light source). It contains an adjustable iris to control the beam diameter of the light. An experienced microscopist can have excellent control over the amount of light illuminating the slide by manipulating the iris, or moving the Abbe condenser up or down. It is very useful at higher magnifications, and for sophisticated microscope use.

Connectors – refers to the types of connectors made between a KAV camera and a computer, TV monitor, VCR, DVR, Audio-Visual Projector, or other display device.

Audio – Usually also an RCA jack and composite cable. Usually the plug and jack are colored white.

Cat. 5 cable – Fifty foot (50' or 15.2m) cable provided with the Ceiling DocCam II, which has RU-45 Jacks at each end, connecting the Ceiling DocCam II, with the RJ-45 plug on the wall plate provided with the Ceiling DocCam II. Function of cable is to carry the video (analog) signal to the wall plate for further distribution of the signal to in room devices such as TV, projectors and the like. The cable also carries power to the camera.

RCA – Is generally accepted as the name of the (usually) color-coded jack used to carry a composite signal. KAV uses an RCA as the composite output, {though in some models an S-Video jack is also available}.

RJ-45 – Plug and connector. Used by Ken-A-Vision only on the Ceiling DocCam II, it is the connectors on either end of the Cat. 5 cable provided with this camera, and provides S-video, composite video, power and RS-232 control, between the camera and the wall plate.

RS-232 – (DE-9 connector for RS-232 interface) Found on the wall plate of the Ceiling DocCam II and is used to connect the camera to control systems for monitoring such as Crestron or AMX.

S-Video – **Separate video**, also known as **Y/C** (or *erroneously*, S-VHS and "super video") is an analog video signal that carries the video data as two separate signals (brightness and color), unlike composite video which carries the entire set of signals in one signal line. [S-Video, as most commonly implemented, carries high-bandwidth 480i or 576i resolution video, i.e. standard definition video. It does not carry audio on the same cable. It is a four (4) pin connector, with each signal pin paired with its own ground pin]. Ken-A-Vision supplies two lengths of S-video cables:
12' (3.66m) – shipped standard with Video Flex 7300, and 7600, Flex Cam iCam Digital (910-171-102), FlexCam (910-171-110), StudentCam (910-171-120), IDCam (910-171-125), TeachCam (910-171-150) and MVP Products.
25' (7.6m) – shipped standard with the Ceiling DocCam II (910-171-066).

USB - Universal Serial Buss a serial bus (connection) standard to interface devices. USB can connect peripherals such as mouse devices, keyboards, gamepads and joysticks, scanners, digital cameras, printers, external storage, etc. For many devices such as scanners and digital cameras, USB has become the standard connection method. [USB also replaced parallel ports which formerly were common on computers].

USB 0.9, 1.0, 1.1 previously common specifications. KAV devices are 1.1 unless designated USB 2.0.

USB 2.0 - as of 2006 the USB specification is at version 2.0 (with revisions). This is a higher data transfer rate than the 1.1 specification. The USB 2.0 specification was released in April 2000 and was standardized by the USB-IF at the end of 2001. Equipment conforming with any version of the standard will also work with devices designed to any previous specification (known as backward compatibility). All KAV USB 2.0 cameras are backward compatible, however there will be a diminution of resolution and pixelization will be more noticeable.

Video - (usually a composite [RCA] connector) - Composite video is the format of an analog television (picture only) signal before it is combined with a sound signal. It is usually in a standard format such as NTSC, PAL, or SECAM. [It is a composite of three source signals called Y, U and V (together referred to as YUV) with sync pulses. Y represents the

brightness or luminance of the picture. U and V between them carry the color information]. Usually the plug and jack are colored coded yellow.

CMOS Camera – Complementary Metal Oxide Semiconductor - In a CMOS sensor, each pixel has its own charge-to-voltage conversion, and the sensor often also includes digitization circuits, so that the chip outputs digital bits which may reduce the area available for light capture. The capture chip requires less off-chip circuitry for basic operation. All purely Digital KAV cameras are CMOS cameras.

Contrast Control button – Contrast Control might be better called Picture. It applies a (gain) to the red, green, and blue signals. It affects the luminance (proportional to intensity) that is reproduced for a full white input signal. Once BRIGHTNESS is set correctly, CONTRAST should be set for comfortable viewing brightness.

Clips – (see Stage Clips)

Composite Output – Composite video is the format of an analog television (picture only) signal before it is combined with a sound signal. It is usually in a standard format such as NTSC, PAL, or SECAM. [It is a composite of three source signals called Y, U and V (together referred to as YUV) with sync pulses. Y represents the brightness or luminance of the picture. U and V between them carry the color information]. Usually the plug and jack are colored coded yellow.

Compound microscope - In the original ‘**simple**’ microscopes, a single light path went through the object viewed and one (1) lens, increasing the visibility of the object by some amount (magnification). (one light path, one lens = **simple** microscope) Compound refers to the fact that in order to enlarge an image, a single light path passes through a series of lens in a line. Each lens magnifies the image over the previous one. (One light path, multiple lenses = **compound** microscope) Usually, a modern compound microscope has multiple lenses (objective lens) within a single eye tube, and a series of three or four objective lenses on the ‘head’ which can be rotated into place. The image produced is a two dimensional (2-D) image.

Comprehensive Scope – Specific name given to the T-1900 series of Ken-A-Vision Compound microscopes.

Cordless (microscope) – Ken-A-Vision cordless microscopes utilize a patented, Nickel Metal Hydride (NiMH) battery system, allowing the microscopes to be operated for approximately 40 hours between charges. Every microscope is shipped with its own charging unit, or the microscopes may be charged using our patented Cordless Microscope Multi-Charger (SCGN06), which will charge 8 microscopes simultaneously. All cordless microscopes should be **charged immediately** upon reception by user, and should **always** be charged prior to any storage of more than 2 weeks duration.

CoreScope – The proper name of our T-1200 series of microscopes both non-digital and digital. These microscopes are designed primarily for use in Elementary and Middle School, and have a Singlet (see Coarse/Fine Adjust) knob for focus adjustment.

Dark/Bright switch – (see bright/dark switch)

Depth of field – With video cameras, the depth of field is the area between the nearest object that is in focus and the furthest object in focus

Diaphragm (Microscopes) - the diaphragm of a microscope regulates the intensity of light entering through the slide and into the objective lens. Ken-A-Vision microscopes come with two types of diaphragms.

Disc – Consists of a series (6 or 8) of openings (apertures) of increasing diameter, located just below the stage.

Iris - A variable, shutter type adjustment which can be set anywhere from full closed to fully open, allowing a very precise adjustment to the amount of light entering into the objective lens.

Field – AN iris type light control, located between the light source and the sub-stage condenser, allowing even greater control of light.

Digital Output – Digital signals are non-continuous, they change in individual steps. They consist of pulses or digits with discrete levels or values. The value of each pulse is constant, but there is an abrupt change from one digit to the next. Digital signals have two amplitude levels called nodes, the values of which are specified as one of two possibilities such as 1 or 0, high or low, true or false and so on. The signal emitted by a Ken-A-Vision camera, on a USB cable connected to a computer is a digital output or signal. (see also Analog output)

Digitize - term used to describe the conversion of an analog video or audio signal into a digital signal that can be used by a computer.

Dimension(s) (or size) – Refers to the actual physical dimensions of a Ken-A-Vision product, usually given as length times width times height. For example, a T-1954 microscope is 8.5" x 5" x 14.5" (21.6cm x 12.7cm x 36.8cm)

DIN – (Deutsche Industrie Normen) represents an international standard for microscope objectives. This standard specifies the exact threading and focal length, and insures compatibility with lenses from any microscope manufacturer in the world.

Diopter - The purpose of a **Diopter** is to allow for a difference in eyesight acuity between two ‘different eyes’. It is present on one eye-tube of all Dual-headed (see Head) Ken-A-Vision microscopes, one eyepiece of a Ken-A-Vision binocular microscope (see Head) or on all Ken-A-Vision digital microscopes. The purpose of a Diopter is to allow compensation of the differences in eyesight between two users (Dual-headed microscopes), between the two eyes of a single user (Binocular microscopes) or between the camera and the view seen in the eyepiece

(Digital microscopes) by the user because the camera is at a different focal length than is the camera position.

Discovery Scope Kit – An accessory for Video Flex and MVP cameras which allows for hands-free observation of specimens by placing the specimen right in front of the camera lens at a short distance to allow magnification to occur. The kit consists of a clamp for attachment to the flexible neck of the camera, a telescoping tube, a set of alligator clips to hold a specimen like a coin, stamp or bug; a bag holder into which specimen's may be placed such as pond water, or moving organisms; two resealable and reusable bags; and 2 waterproof plastic boxes for holding specimens.

Dissecting Microscope (see Vision Scope)

Dual Opposing Head – (see Head – Opposing)

DVR – Digital Video Recorder (DVR) (or personal video recorder (PVR)) is a device that records video without videotape to a hard-drive -based digital storage medium. The term includes stand-alone set-top boxes and software for personal computers which enables video capture and playback to and from disk. These are replacing VCRs as a preferred way of recording images.

Exposure (see also Contrast) – is the amount of illumination reaching the imaging chip of a camera – it is regulated by an internal iris in most Ken-A-Vision cameras or may be adjusted by using Applied Vision™ for Windows software.

Eyepiece (microscopes)

Widefield - an eyepiece with an acromatic doublet lens which allows the observer to viewing through the whole lens diameter rather than being limited to viewing only in the center of the field. The enlarged opening allows a large non-distorted viewing of the microscope field, making it easier, particularly for novice observers to use the microscope, because the position of the eye does not have to be 'perfect'. Ken-A-Vision microscopes come standard with 10X, widefield eyepieces

Pointer – inside the eyepiece of Ken-A-Vision microscopes is a fine hair 'pointer' which goes about half way across the visual field. The purpose of the pointer is so that a user might place a specific part of the field at the end of the pointer, allowing them to them share it with another user. E.g. a teacher might put a cellular structure at the end of the pointer so that they are sure the student is looking at the correct object.

Field Diaphragm (see Diaphragm)

Flexible

Flexible Neck (KAV) – includes the Video Flex, Vision Viewer and MVP lines of Ken-A-Vision cameras.

Flexible Neck (by KAV) – includes the flexible necked cameras now manufactured and sold by Ken-A-Vision, that were formerly made and sold by ClearOne (Video Labs) – (acquired by Ken-A-Vision in 2006).

Flip – is a property of some Ken-A-Vision camera drivers, not of Applied Vision™ for Windows Software. In those cameras that have the Flip functionality, once Applied Vision™ for Windows is open, click on the Video Tools (Hammer, Pliers and Screwdriver), to open the Video box. Within the Video box click on the camera (left side of box). Depending upon the camera driver that has been activated, a series of tabs will open. Select the tab Video Image, and within this box there will be either the choices Flip and Mirror, OR Vertical Flip and Horizontal Flip. Using either of these paired commands will, convert the image from one document orientation to the opposite document image.

Mirror – Will shift the image to the mirror image of the original.

Flip – Will turn the image 180° from the original image.

Flip Horizontal – will turn the image 180° from the original image.

Flip Vertical –Behaves like Mirror, will shift the image to the mirror image of the original.

Flip Horizontal – (see Flip)

Flip Vertical – (see Flip)

Floating Stage – A microscope stage which may be moved in multiple directions with the microscope slide clipped on its surface. It replaces the need for a mechanical stage on some microscopes.

360° – Found on the T-1700 series of microscopes, allows movement of the stage in a 360° range.

x/y – Found on the T-1941 Dual Purpose microscope, allows movement of the stage along the X and Y axes, but not Z, so therefore not 360°.

Fluorescent Control Switch – Found on 7300 and 7600 Video Flex and MVP cameras. There is also a fluorescent control found in the Applied Vision™ for Windows software. Both will reduce the flicker caused by the ballast some older fluorescent lights in a room, and improves some dim light problems.

Fluorescent (light source for microscopes) – Source illuminator on some models of microscopes. At Ken-A-Vision fluorescence illumination is now optional on a limited number of microscopes. Primary benefit of a fluorescent light source is that the amount of heat generated by the illuminator is severely reduced from a traditional incandescent or tungsten filament light.

Fluorescence microscope – Ken-A-Vision does not currently carry any of these specialized microscopes necessary for detecting organelles that have been marked with fluorescent dyes for rapid location and identification.

Focus

Auto – see Auto Focus

Coarse/Fine Adjust – see Coarse/Fine Adjust

Manual – see Manual Focus and Quick Focus

Quick Focus – see Quick Focus

Focusing types (on microscopes)

Coaxial Controls – Consists of two knobs where one smaller, knob (fine adjust) is centered on top of another, larger knob (coarse adjust). This is a feature of all Ken-A-Vision compound microscopes except the 1200 series for elementary students.

Singlet Control – one knob does both coarse and fine adjustment.
Excellent for novice and young microscope users.

Rack and Pinion – refers to the interlocking of a series of gears and cams that allows the coarse and fine adjustment knobs to interact. All Ken-A-Vision microscopes have a rack and pinion system except the ESH 200.

Focal (focus) distance –

Microscope, focal distance is the space between the end of an objective (lens) and the surface of the specimen or slide. As magnification increases, focal distance decreases.

Camera – focal distance is the space between the lens of the camera, and the surface of the object being converted into an image. With Ken-A-Vision cameras, as the focal distance decreases, the magnification increases.

Frame - One complete still image of video media. Video media is made up of a series of frames. Each video frame has two interlaced fields.

Frame rate – (Image rate) - number of times per second the image is refreshed per second. NTSC has a general frame rate of approximately 30 frames per second (fps) (actual 29.97). PAL has a frame rate of 25 fps). (See also Video Standards – NTSC and PAL below)

Freeze – Button found on MVP products and the T-1955 (Network Memory Scope) which will cause the image to be fixed (not live) until button activated again.

Halogen light (see Light sources)

Hanover Bars – (see Video Standards-PAL)

Head (Cameras)

Ball and socket - literally a ball, which rotates in a socket allows camera head to be maneuvered over a 90° range of motion. Found in all Video Flex and Vision Viewer Cameras **except** the 2100 (Explorer), 5500 (ClipCam), 7811 (BookCam), 7821 (ShopCam), 7870 (PhysicsCam), and 910-171-066 (Ceiling DocCam II). With the exception of the DocCamPro™ AV (910-171-010) none of the FlexCams by Ken-A-Vision are ball and socket.

90° Fixed – Camera head is fixed to the end of the flexible neck. All the exceptions listed above under Ball and Socket, including the FlexCams by Ken-A-Vision (except the Ceiling DocCam II) are 90° Fixed head cameras.

Head (Microscopes)

Monocular - single eye tube, set at 45° to the head for viewing by one observer at a time.

Dual Opposing) Head - Two eyepieces, each of which are at 45° to the head of the microscope, and set at 180° from each other. This allows two observers to use the microscope simultaneously, for example a teacher and the student.

Binocular – Two eyepieces, usually on a slide mechanism. The interpupillary distance is adjusted side-to-side, by sliding the eyepieces towards and away from each other.

Seidentopf binocular – Two eyepieces, with the head designed so that by increasing or decreasing the distance between the two eyepieces (interpupillary distance) is done by twisting the eyepieces in an up and down arc motion similar to most binoculars.

Triocular - This microscope has a binocular head for viewing and an additional eyepiece for a camera mount. Ken-A-Vision trinocular heads have an 80:20 split feature so that when a slide adjustment feature is in position one, 80% of the light comes to the camera and 20% comes to the binocular head, allowing a view of what the camera will see. In the opposite position the slide allows 100% of the light to get to the binocular eyepieces.

Tucked Reverse – In a compound microscope, the objectives are placed such that they are positioned back towards the arm of the microscope allowing for ease of inserting or removing slides from the stage.

Vertical binocular – Only the Ken-A-Vision T-2400 has this feature. The binocular lens are placed vertically, directly above the objective lenses.

45° Angle - All Ken-A-Vision microscopes are position with a 45° angled head, allowing for an ergonomatically comfortable position for the average microscope user.

360 ° Rotation – By loosening a knurled set screw, most Ken-A-Vision microscopes allow for the head to be rotated 360° on the microscope stand, so that the eyepiece can be viewed from any side without moving the whole microscope.

Image Rate – (see Frame Rate, and Video Standards)

Image Resolution - A measurement of the quality of a video image based on the number of pixels that make up the image.

Incident Light (see Light Sources)

Iris (Camera) – As a general principle, the iris of a camera adjusts the brightness of the image. On CCD cameras, there is a physical iris whose opening is adjusted by electrical impulse. The iris of a camera changes the incident light striking the video chip. On CMOS cameras, white balance is adjusted by driver properties, changing the brightness of the image. (see also White Balance)

Iris diaphragm (microscopes) – a device consisting of thin, overlapping metal plates that can be adjusted to form an aperture of varying diameter regulating the amount of light entering the microscope. In Ken-A-Vision microscopes it is included as a part of a sub-stage Abbe condenser apparatus. (see also Condenser-Abbe)

JPEG - **Joint Photographic Experts Group**. An international standard for still picture data compression. In Applied Vision TM for Windows, this is the default storage mode for single images.

Ken-A-Vision Capture for Macintosh – (also see software) – A viewing and capture application for Macintosh OS 10 and above. It is provided with all cameras which are supported on OS 10. User is then able to utilize all Macintosh image software available to them on their Macintosh computer.

Ken-A-Vision Cool Lighting (see light sources)

Kensington (lock and slot) - A Kensington Security Slot (also called a K-Slot or Kensington lock) is a small hole found in the base of Ken-A-Vision cameras. It is used for attaching a lock, in particular those from Kensington Technology Group. The locks are generally secured in place with a key or some mechanical pin device and attached with a strong metal cable to some permanent object, such as a heavy table or other similar equipment. Provides limited security.

Kohler Illumination (microscopes)– Kohler illumination is a technique that provides optimum resolution and contrast in a light microscope by aligning and focusing the illumination and critical setting the apertures of the microscope to best match the objective lens Numerical Aperture. (see any good book on microscopy) – (see also Numerical Aperture)

Laser alignment (tool, guide. or feature) – found on the Ceiling DocCam II (910-171-066) camera. When laser is activated it ensures proper document orientation by indicating where a document should be placed for best viewing on the table below the camera. Laser displays for five seconds when the camera is first powered on.

Lens(es)

Achromat - A combination of lenses made of different glass, used to produce images free of chromatic aberrations.

f-stop (e.g. f1.4-f2.8) - the f-number (sometimes called focal ratio, f-ratio, or relative aperture of an optical system expresses the diameter of the entrance pupil in terms of the effective focal length of the lens. It is the quantitative measure of lens speed.

8 mm – Standard lens on all Video Flex cameras and all FlexCams by Ken-A-Vision. Refers to the physical diameter of the original lens. Field of view is slightly smaller than the field of view of a 6 mm.

6 mm - Standard lens of all Vision Viewer cameras. The field of view of a 6 mm lens is slightly larger than that of an 8 mm lens.

C-Mount – see C-mount lens

Objective lens - (see Compound lens)

Light sources

Ken-A-Vision Cool Light - becoming standard on all ESH, T-1100, T-1200, T-1700, T-1900 Ken-A-Vision microscopes. It consists of a variable (depending upon model) number of specialized LED lights. Importance is that the light source does not generate significant heat, damaging living specimens.

- Halogen – Incandescent bulb in which the filament is tungsten, but the gas filling the glass envelope is halogen (iodine or bromine generally). The presence of the halogen increases the length of the bulb's life. Halogen lamps tend to be run at higher temperatures which allows higher luminous efficacy, apparent brightness, and whiter color temperature (see Color Temperature). Microscopes with halogen lamps, give more intense, white light, but also emit considerable heat which can quickly kill living specimens.
- Transmitted (light) – In microscopes, transmitted light refers emitted from the illuminator (light source) and passes through the slide or specimen to the objective lens.
- Incident (light) – refers to any light that falls on the specimen or slide on the microscope. In Dissecting (Stereo microscopes or Ken-A-Vision VisionScopes) the incident light is provided by a top of supra-stage light source, which illuminates the top surface of the specimen or slide. The light is generally not transmitted through the specimen or slide.
- Tungsten - In most standard incandescent lights, the filament that is activated and glows to emit light is made from Tungsten. Characteristic of Tungsten lamps is that they give intense, white light, but also emit considerable heat which can quickly kill living specimens.
- Light Rheostat – a device which allows for adjustment of light intensity on a microscope, similar to a room dimmer switch. Actual effect is produced by placing a variable resistor in the circuit causing the current applied to the light to vary.
- Light Sensitivity – In Ken-A-Vision cameras, refers to the amount of incident light needed to activate the camera chip. The smaller the number the less light needed to produce an image on the camera.
- Luminance - Black and white portion of a video signal representing picture contrast and brightness.
- Macro – A combining form which meaning long (in extent, or duration) large, enlarged, or elongated. It is the opposite of –micro.
- Magnification - is to make something larger in size then it really is by use of lenses. In microscopes, this is usually indicated by the abbreviation "X". So a 10X eyepiece will magnify the image on a slide by 10 times. To determine total magnification of a specimen by a microscope, simply multiple the eyepiece magnification times the objective magnification. (for example –if the eyepiece is 10X and the objective is 10X then the total magnification would be 100X). As magnification increases, generally more light is needed to maintain the same level of resolution (defined below)

Manual Focus – any operation where the user or operator must change the focal length by adjusting the coarse/fine adjust of a microscope, or rotate the focusing ring of a camera.

Materials – What a thing is or made of.

Isotropic – having physical properties, as conductivity, elasticity or light transmittance that is the same in all directions.

Anisotropic – NOT having physical properties, as conductivity, elasticity or light transmittance that is the same in all directions.

Opaque – a material which will not allow light to pass through.

Mechanical Stage (Stage Manipulator) – a specialized kind of mechanism, into which a slide may be inserted, and then the slide moved around with great precision, and in very small increments. Most mechanical stages have both an 'X' and a 'Y' Vernier, allowing exact marking of location of an object on a microscopic slide.

Megapixel - A pixel (short for picture element, using the common abbreviation "pix" for "picture") is a single point in a graphic image. Each such information element is not really a dot, nor a square, but an abstract sample. The intensity of each pixel is variable; in color systems, each pixel has typically three or four dimensions of variability such as red, green, and blue, or cyan, magenta, yellow and black. A Megapixel is 1 million pixels, and is a term used not only for the number of pixels in an image, but also to express the number of sensor elements of digital cameras or the number of display elements of digital displays. For example, a camera with an array of 2048×1536 sensor elements is commonly said to have "3.1 megapixels" ($2048 \times 1536 = 3,145,728$).

Micro – a combining form meaning little, small or minute. It is the opposite of –macro.

Mirror – (see Flip)

Monocular head (see Head-monocular)

Mirror – (see Flip – Mirror)

Multi-Charger – An eight station unit for charging Ken-A-Vision Cordless Microscopes which contains a microprocessor for each charging station controlling the charge to each unit receiving. The microprocessor prevents overcharging and is energy efficient. It charges the NiMH (Nickel Metal Hydride) batteries found within Ken-A-Vision Cordless Microscopes within eight hours. Great for charging your microscope while they are being stored. Individual LED indicators indicate when microscope is charging and when it is fully charged. Each charging station has a 6 foot cord for connecting to the microscope.

NiMH Batteries (Nickel Metal Hydride) - Ken-A-Vision batteries for cordless microscopes are specially made batteries of the NiMH type. Technically A **nickel metal hydride battery**, abbreviated **NiMH**, is similar to a nickel-cadmium (NiCd) battery but has a hydrogen-absorbing alloy for the anode instead of cadmium. Like in NiCd batteries, nickel is the cathode. A NiMH battery can have two to three times the capacity of an equivalent size NiCd.

Nickel Metal Hydride Batteries (see NiMH)

Non-cordless (microscope) (wired) – Ken-A-Vision microscopes are all shipped with a removable power cord (or charger/adaptor), **Exceptions** include the T-2400, T-2700, and T-3300 series of microscopes, which have a permanently mounted power cord.

NTSC – (see Video Standards)

Numerical Aperture - the numerical aperture (NA) of an optical system is a dimensionless number that characterizes the range of angles over which the system can accept or emit light. [In microscopy, the numerical aperture of an objective lens is defined as $NA = n \sin \theta$, where n is the index of refraction of the medium in which the lens is working (1.0 for air, 1.33 for pure water, and up to 1.56 for oils), and θ is the half-angle of the maximum cone of light that can enter or exit the lens.] In microscopy, NA is important because it indicates the resolving power of a lens. The size of the finest detail that can be resolved is proportional to λ/NA , where λ is the wavelength of the light. A lens with a larger numerical aperture will be able to visualize finer details than a lens with a smaller numerical aperture. Lenses with larger numerical apertures also collect more light and will generally provide a brighter image.

Objective Lens(es) – Objective lenses are designed to maximize the ultimate resolution of the microscope. Three criteria are balanced in the design of a high resolution objective. These include consideration of the wavelengths of light emitted by the light source used on the microscope, the refractive index of the space between the front of the objective lens and the specimen (focal distance) and the angular opening (aperture) of the light cone captured by the objective.

Ocular (see eyepiece)

Opaque materials (see materials)

Output – Electronic

Analog – see Video output

Audio – see Audio output

Digital – see Digital output

Network – see Network output

RJ-45 – see Network output

S-Video – See S-video output

Video – see Video output

15 pin D Sub – see Video output

Output – Video Resolutions Expressed in Pixels

VGA - 640 X 480

SVGA - 800 X 600

XGA - 1024 X 768

SXGA+ - 1400 X 1050; 1280 X 960 also in some sources

UXGA - 1600 X 1200

QXGA - 2048 X 1536

QSXGA+ - 2800 X 2100

QUXGA - 3200 X 2400

PAL – see Video Standards

Pixel - A single picture element. The smallest element in a graphic image. Pixels are combined with other pixels to make up a graphic image. Picture quality increases as the number of pixels increase in a measured area of an image.

Planetary – (see Coarse/Fine Adjust)

Pointer (see eyepiece pointer)

Positive/Negative Switch – Reverses the image of the camera, from the positive colored image, to its video negative image.

Power Adapter – (charger) - Ken-A-Vision cordless instruments, and some cameras are supplied with an removable power cord, which may be either used as a standard wall plug in source of power for the instrument, or as a charger of batteries in cordless units. The exact one provided is dependent upon the specifications of the purchaser, or in lieu of that the specifications of the country of use.

Power Supply – Country specific eight foot UL approved wire with the correct male plug for country of use, or as requested by the purchaser.

PrepScope – The name given to the T-1200 series of Ken-A-Vision microscopes. They have 4X, 10X, AND 40X objectives and a single large coaxial coarse/fine adjust knob for use by Elementary and Middle School children.

Quick Focus™ – Trade marked feature of the Video Flex line of Ken-A-Vision cameras. Within a 90° turn of the knurled knob on the face of the camera, the user can focus from extreme close up (less than 1 inch from front of camera) to infinity.

Rack and Pinion – (see Focusing Types)

RCA connector – (see connectors)

Resolution (See Appendix A for more exhaustive detail on video resolution)

Image Resolution - A measurement of the quality of a video image based on the number of pixels that make up the image.

Microscope - is the ability to tell two points apart as separate points. If the resolving power of your lens is 2 μ m that means two points that are 2 μ m apart can be seen as separate points. If they are closer together then that, they will blend together into one point.

Video - While all (NTSC) TV sets and program material (broadcasts, tapes, disks, etc.) use the same 525 scan lines, the advertised resolution (240, 425, 500, etc.) refers to the horizontal resolution which is the number of side by side dots that can be reproduced within any one line.

The number of scan lines is the limit for vertical resolution, the number of dots in a column that can be reproduced. It is pretty much the same for all decent NTSC TV sets of moderate or large size. (See also Appendix A)
(For definitions of various advertised resolutions – XGA etc. see Output – Video Resolutions Expressed in Pixels)

Rheostat – (see Light Rheostat)

RJ-45 connector – (see connector – RJ 45)

RS-232 connector – (see connector – RS-232)

Seidentopf Binocular head – (see Head-Seidentopf)

Singlet Control - see coarse/fine adjust

Size - (see Dimension)

Smear – This is an image artifact that can affect the quality of the image (**Blooming** is another artifact – see above). Smear is defined as light leakage into the transfer part of the CCD camera chip, causing unwanted vertical lines in the image. It results in a distorted image but can be avoided by using correct lighting,

Software

Applied Vision™ for Windows - Ken-A-Vision's own software (Version 3.0 available Spring, 2007) which works seamlessly with Ken-A-Vision digital USB products. It allows for the capture of single images, time-lapse sequences, time-lapse movies, and movies. Advanced functionalities such as image amalgamation, measurement, and image marking are also available. Images are exportable to Word, WordPerfect, Power Point and other equivalent presentation programs.

Ken-A-Vision Capture for Macintosh – Ken-A-Vision Capture is a Mac OS X application allowing users to capture images, record movies, and display full-screen video from supported Ken-A-Vision cameras.

Stage Clips – Ken-A-Vision patented spring loaded clips provided as standard on all Ken-A-Vision microscopes. (Except ESH models)

Stage Manipulator (See Mechanical Stage)

Standards – see Video Standards

S-Video (output) – (see also connectors) - **Separate video**, also known as **Y/C** (or *erroneously*, S-VHS and "super video") is an analog video signal that carries the video data as two separate signals (brightness and color), unlike composite video which carries the entire set of signals in one signal line. [S-Video, as most commonly implemented, carries high-bandwidth 480i or 576i resolution video, i.e. standard definition video. It does not carry audio on the same cable. It is a four (4) pin connector, with each signal pin paired with its own ground pin].

Stereo Microscope (see Vision Scope)

Transmitted Light (see Light Sources – transmitted light)

Triocular (see Head – Trinocular)

Tucked Reverse (see Head – Tucked Reverse)

Tungsten light or lamp (see light Sources)

USB – Universal Serial Bus Controller – see Connections

USB Adapter – An accessory allowing the conversion of an analog signal to a digital signal. Currently Ken-A-Vision sells two such units USBAD2 (which comes with Applied Vision™ for Windows and Ken-A-Vision Capture for Macintosh) and/or 910-171-318, which has video pass-through capability.

VCR – Video Cassette Recorder – Records image captured on camera (or from an analog source such as a TV, and places the signal usually on VHS or similar tape.

Venetian Effect - Venetian Blind Wipe - A transition that produces the effect of having an outgoing clip displayed in strips over the incoming clip. The strips open, like a Venetian blind, to reveal the incoming clip.

Vertical Binocular (see Heads)

Video Output

Composite – see Composite Output, also Connectors Composite

S-Video – see S-Video, also Connectors S-Video

Video Standards -

NTSC - is the analog television system in use in Canada, Japan, South Korea, the Philippines, the United States and a few other countries in the Americas. It is named for **the National Television System(s) Committee**, the U.S. standardization body that adopted it. In 1941 the committee settled on a 525-line transmission standard, with a frame rate of 30 frames per second, with an aspect ratio of 4:3, which is still basically the United States Standard to this day. The NTSC format is used with the M format which consists of 29.97 interlaced frames of video per second. Each frame consists of 484 lines out of a total of 525 (the rest are used for sync, vertical retrace, and other data such as captioning). The NTSC refresh frequency was originally exactly 60 Hz in the black and white system, chosen because it matched the nominal 60 Hz frequency of alternating current power used in the United States

PAL – short for **phase-alternating line, phase alternation by line or phase alternation line**, is a color encoding system used in large parts of the world, predominantly in Europe (except France which uses SECAM). PAL uses 625 lines, and a 50 Hz refresh rate, (which recently has been changed to 100 Hz to reduce flicker rate). [Hertz (Hz), stands for cycles per second] This gives a better quality and more stable picture. PAL format as it has greater resolution than NTSC, is generally better than the latter, especially for DVD movies. However, the alternation of color information - **Hanover Bars** - can lead to picture grain on pictures with extreme phase errors even in PAL systems

SECAM – also written SÉCAM (Séquentiel couleur à mémoire, French for "sequential color with memory"), is an [analog color television](#) system first used in France. It is similar to PAL, it also uses 625 lines and a 50 Hz system. As color television became popular, there was a requirement that monochromatic (black and white) television sets remain compatible. Because of the requirement, color standards add a second signal to the basic monochrome signal, and this signal carries the color information, called chrominance (or C in short), while the black and white information is called the luminance (Y in short). Old TV receivers only see the luminance, while color receivers process both signals. In order to get color, and not increase bandwidth, the color signal has to be somehow inserted into the monochrome signal, without disturbing it. This insertion is possible because the spectrum of the monochrome TV signal is not continuous, hence empty space exists which can be utilized. This lack of continuity results from the discrete nature of the signal, which is divided into frames and lines. Analogue color systems differ by the way in which empty space is used. In all cases, the color signal is inserted at the end of the spectrum of the monochrome signal. The color space is three dimensional by the nature of the human vision, so after subtracting the luminance, which is carried by the base signal, the color sub carrier still has to carry a two dimensional signal. Typically the red (R) and the blue (B) information are carried because their signal difference with luminance

(R-Y and B-Y) is stronger than that of green (G-Y). SECAM differs from the other color systems by the way the R-Y and B-Y signals are carried. First, SECAM uses frequency modulation to encode chrominance information on the sub carrier. Second, instead of transmitting the red and blue information together, it only sends one of them at a time, and uses the information about the other color from the preceding line. It uses a delay, an analog memory device, for storing one line of color information. This justifies the "Sequential, With Memory" name. Because SECAM transmits only one color at a time, it is free of the color artifacts present in NTSC and PAL and resulting from the combined transmission of both signals.

Vision Scope – Ken-A-Vision's name for microscopes specifically designed for looking at large (macro) objects such as coins, stamps, whole organisms, etc. It is an analogous term to Dissecting Microscope or Stereo Microscope. Vision Scopes differ from Compound Microscopes because within the head of the objective there are two parallel lens systems, both viewing the specimen in parallel, giving a three dimensional image to the viewer. All Vision Scopes have both transmitted and Incident light.

Wall Plate - Provided with a Ceiling DocCam II, provides the connecting site for the signal being transmitted from the ceiling camera, and allows output of a composite or S-Video signal, which in turn may be connected to a projector, TV VCR or DVR.

Warranty – refers to the standard amount of time in which Ken-A-Vision will replace a product that is defective or fails to operate, as long as the failure is not due to abuse or misuse of the product.

Weight – Quantity or amount of heaviness, how much does the Ken-A-Vision product weigh for purposes of shipping.

White Balance – Is the need for a video chip in a camera to 'know' what white (the combination of all color) is in a given lighting and color situation. By setting while balance, one tells the camera which object in the room is white and supposed to come out white in the picture. The camera can calculate the difference between the current color temperature of that object and the correct color temperature of a white object and then shift all colors by that difference. Most advanced digital cameras provide the feature to manually set the white balance. By pointing the camera at a white or gray card (angled so that it is reflecting light from the room) as a neutral reference, filling the screen completely with it, then pressing the White Balance button (or set it in the menu), the camera does its White Balance calculation. **(See also APPENDIX B for more exhaustive detail).**

Widefield eyepiece (see Eyepiece - Widefield)

x/y Floating Stage (see Floating Stage)

Zoom - On a camera, to change the focal length to/from wide-angle and telephoto. In post-production, an editing filter that simulates the effect of having a camera move in very close to the subject, objects, or areas in a frame; or move away from the subject and display a wide view of the entire frame

APPENDIX A – Detailed descriptions of Microscope and Video Resolution

Microscope Resolution

Resolution is the ability to tell two points apart as separate points. If the resolving power of your lens is $2\mu\text{m}$ that means two points that are $2\mu\text{m}$ apart can be seen as separate points. If they are closer together than that, they will blend together into one point.

Magnification is something different-the ability to make an object larger. If the resolving power of a microscope is poor, it will just magnify a blurry object. They are separate properties.

Video resolution, though it does refer to being how well fine details may be seen, is actually quite different in the way it is described.

TV and Video Resolution

The TV and Video description below should in large part be attributed to Allan W. Jayne, J., P.O. Box 762, Nashua, NH 03061 as seen on the web site <http://members.aol.com/ajaynejr/vidres.htm>, from which some images and text were adapted.

First a quick note for clarity. The primary difference between NTSC (TV's in North America and Japan) and PAL (Rest of world except France and French colonies) formats is the amount of resolution. Most experts feel PAL has higher resolution. Basic technical differences between two formats involves way lines are swept on and off the TV, and not the technical way resolution is defined.

We must first describe the horizontal and vertical resolution for television and video.

There are at least three major subtopics for resolution,

1. For the TV set itself, its ability to reproduce fine detail in terms of how small a spot or how thin a line it can make on the screen, for example 500 lines (or alternating light and dark dots) of resolution.
2. For the transmission (e.g. broadcast) or storage (e.g. DVD) format, the amount of detail that can be retained or conveyed, for example 720 by 480 pixels in a rectangular frame,
3. How effectively the method of recording (video camera) captures live subject detail (Kell Factors).

All of this contributes to the final measure of resolution, what you see in terms of Venetian blinds, picket fences, or polka dot clothing.

Resolution Factoids,

While all (NTSC) TV sets and program material (broadcasts, tapes, disks, etc.) use the same 525 scan lines, the advertised resolution (240, 425, 500, etc.) refers to the horizontal resolution which is the number of side by side dots that can be reproduced within any one line.

The number of scan lines is the limit for vertical resolution, the number of dots in a column that can be reproduced. It is pretty much the same for all decent NTSC TV sets of moderate or large size.

If the video signal is converted and processed digitally at any time, there will be a horizontal pixel count. This pixel count becomes the upper limit for horizontal resolution. (Such as if signal is put through the Ken-A-Vision USBAD2 or what happens in a 7600 or MVP camera).

Both horizontal and vertical resolution also depend on how tiny a spot can be produced on the screen. The finite number of scan lines and, for digital video, the number of pixels horizontally also limit the smoothness of diagonal lines and the resolving of position of fine details.

Traditionally, "lines of resolution" is correctly measured across the largest circle (must be a circle not an ellipse) that fits in the space you are talking about. However some advertisers exaggerate using the entire screen width or using some electronic formula that only covers part of the circuitry. Modern standards stating resolution or screen dimensions in "pixels" (dots) reflect the entire screen width or height, not just the circle.

For NTSC, the picture occupies approximately 480 of the 525 scan lines. For video broadcasts the portion of a scan line that is visible can hold up to about 440 dots so a grid 480 high by 440 wide represents the maximum amount of picture detail possible.

Advertised resolution applies to blacks, grays and whites only. Color resolution is much less. The human eye and brain are less sensitive to lack of color within fine detail.

“Lines of Resolution” for video include both the black lines and the white spaces between them in a test pattern but not the gaps if any between scan lines or between phosphor dots/stripes.

The more brightness and color changes, representing picture detail, the greater the circuitry bandwidth and broadcast channel apace needed. Horizontal resolution is the first to be affected by bandwidth limitations.

Loss of resolution

Resolution may be lost by any one or combination of the following factors:

1. During capture of the picture information by the camera and electronic processing of the fresh video signal,
2. In the process of storing the picture information on disk or tape, or transmitting it over the air on via satellite or "cable",
3. During playback, in the TV set, also in VCR and disk player electronics.

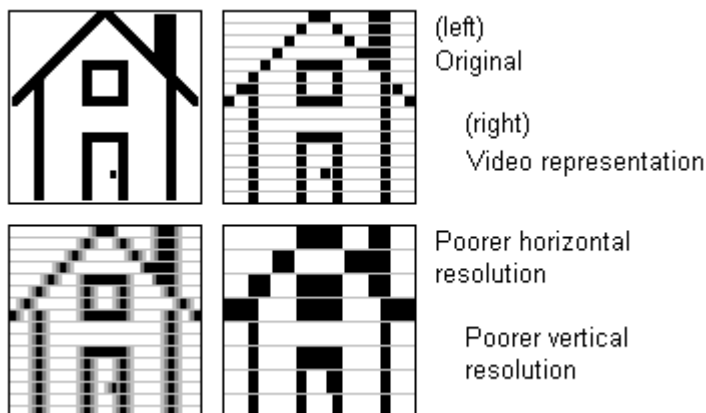
Aspect Ratio

The **aspect ratio** of an image is its displayed width divided by its height (usually expressed as "x:y" or "x×y," with the joining colon or multiplication symbol articulated as the preposition "by" or sometimes "to"). For instance, the aspect ratio of a traditional television screen is **4:3**, or 1.33:1. High Definition Television and European digital television use an aspect of **16:9**, or about 1.78:1.

Quick Description of Vertical and Horizontal Resolution

The more scan lines we have, the better the vertical resolution is possible. That is, the more dots in a column, or thin lines lying flat in a stack, can be reproduced and distinguished. When portions of several scan lines in a row are the same at a particular place on the screen we are reproducing coarse detail. When adjacent scan lines differ, we are reproducing fine vertical detail. Since each video standard has a fixed number of scan lines (525 for NTSC, 625 for PAL), vertical resolution is the same for all TV sets of the same standard except the poorest quality, defective, or very small sets.

Advertised resolution is the horizontal resolution and it varies with the quality of the TV set. Side by side thin upright lines, whose cross section is a row of dots, are used to measure horizontal resolution. To resolve horizontal detail, the electron beam changes to make dots (and dashes) of different colors, along each scan line. The finer the detail we need to reproduce, the tinier a spot the electron beam must be able to make.



The conglomeration of all those dots and dashes on all the scan lines equals the picture.

Since the electron beam "paints" the screen at a constant speed, the finer the horizontal detail (smaller dots), the faster the changes must be. The faster the changes, the higher the frequency the video signal must be able to attain. Since signal frequency is one of the limiting factors for video information storage and transmission, horizontal resolution is the first to be affected.

The Circle Rule

When measuring "lines of resolution" for TV sets or monitors, a reference distance needs to be specified. Traditionally, video resolution is measured across the largest circle (not an ellipse) that fits in the space we are talking about. All the technical books on video say this, although using different words. On a standard TV screen such a circle would span $\frac{3}{4}$ of the screen width. For U.S. HDTV (16:9 aspect ratio) the circle would span a little over half the screen width. Since the circle exactly fits the screen height (assuming no overscan), the phrase "picture height" stands for a distance equal to the diameter of the circle and is also used when talking about horizontal resolution. The circle rule also applies to film.

Under this rule, if a standard (4:3 Aspect Ratio) TV set can reproduce 800 dots alternating black and white across the screen width using an input signal representing same, it is said to have 600 lines of horizontal resolution. However if the source material had just 330 lines of resolution you will see just 330 lines of resolution. A 16:9 aspect ratio TV that can reproduce just 800 dots across its screen would have 450 lines of horizontal resolution.

Technical term: Cycles per picture height -- One cycle of a simple video signal waveform consists of an "up" which makes a dark dot or dash and a "down" which makes a light dot or dash. At the 4.2 MHz maximum usable NTSC broadcast video frequency, at most 165 cycles can occur while the electron beam is drawing inside the circle we were talking about above so we can say that the horizontal resolution is 165 cycles per picture height. The term "cycles per picture width" is also used but less often. Incidentally one cycle corresponds to one "line pair" in photographer's terminology.

For film "lines of resolution" is typically measured as per millimeter. We cannot easily use "lines per inch" to describe video resolution because we would expect two TV sets of the same quality but with different sized screens to have about the same horizontal resolution, and exactly the same the vertical resolution. This has led to the phrase "per picture height".

When pictures are transmitted or stored digitally, each scan line has to be broken up into dots called pixels. Both the vertical and full width horizontal pixel counts are specified, representing a rectangular grid. A common computer video resolution is called VGA and is stated as 640 by 480 pixels. Here the aspect ratio does not have to be known or stated. For analog video (broadcasts, VHS tape, laser disks) we can think of the horizontal pixel count as the maximum amount of the finest details that can be put on a line and still be distinguished. The video source may have a given resolution in pixels but if the TV

cannot make spots small enough, what should be individual closely spaced dots will be a continuous blur..

Published Resolution is for Black and White

(Applies to transmission and storage and also to displaying of video)

All horizontal resolution figures published for video, if not otherwise qualified, apply to blacks, grays, and whites only. All of this has to do with maximum signal frequency and limits on what will fit into the broadcast channel or on VHS tape, etc. The luminance signal, also called *luma*, or Y, contains all the information needed to produce the video picture but in black and white. It is transmitted or recorded with enough bandwidth to carry the desired or maximum possible horizontal resolution of the subject material. Color is broadcast using a second signal (called the chrominance, chroma, or C signal). It has much less bandwidth, in some cases as low as 0.5 MHz allowing only 40 lines (broad stripes) of horizontal resolution. Small horizontal details (dots along a scan line) therefore cannot be of alternating contrasting colors. The human eye and brain do not notice loss of color in the finer details of a motion picture as much as they sense blurring of the light and dark content.

Improved color resolution is a significant factor in the quality of digital TV programs such as on DVD.

Both the Black Lines and White Spaces Count

Resolution is measured using charts with closely spaced dots, parallel lines or approximately parallel lines, the more that can be distinguished in a given area, the better the resolution. In order to see a series of dark lines we must have light spaces in between them. For film, "lines of resolution" count only the dark lines, not the spaces in between. Because video has much lower resolution than film, video people count both the dark lines and the light spaces as "lines" in order to have larger numbers to talk about. The term "television line" or "TVL" thus refers to scan lines vertically or the smallest possible dots on a line horizontally. In response to this, film folks have resorted to using the phrase "line pair" to stand for a dark line together with the light space to one side. Sometimes the scan lines are thin enough that dark gaps are seen between them. These gaps, and also the dark boundaries between red, green, and blue bars or dots on the picture tube face, do not count as lines of resolution.

An Example (NTSC broadcasting)

To show a movie (motion picture) in the theater, still pictures are flashed on the screen one after another, 24 frames of the film strip per second. For TV programs it is 30 frames per second. Once we start discussing things that repeat many times per second we must bring the words cycles, megahertz, and frequency into our discussion. (Hertz is short for "cycles per second".)

The first number that comes to mind when talking about NTSC video is 525, the number of horizontal stripes or scan lines drawn across the screen to construct the picture. The

scan lines are drawn as follows: 240* odd lines of picture information, 22* black lines, 240* even lines of picture information, 23* black lines. This is all repeated 30± times a second. The "black" lines contain information to keep the TV set scanning in synchronism with the broadcast and allow time to get the electron beam back to the top of the screen. They also contain coded information for closed caption text, commercial identification and tracking, etc.

To create picture detail the electron beam makes tiny dots and dashes as it draws each scan line. With 525 scan lines redrawn 30 times a second, millions of these dots and dashes are needed every second. Electronically the NTSC broadcast video signal uses frequencies up to 4.2 million cycles per second (MHz). Every cycle has an "up" that represents a dark dot and a "down" that represents a light dot, thus 4.2 MHz can represent 8.4 million dots per second. To make coarser detail (dashes) the cycles are stretched out, or represent lower frequencies. To make shades of gray the ups and downs are not so high or deep. At this rate we can get a maximum of 533 dots per scan line. Not all of these dots can be used for picture detail. In the early days of TV, the last seventeen percent of each scan line had to be made black to hold synchronizing information and to get the electron beam back to the left side to draw the next line. The remaining 83% of a scan line holds 442 dots which is the maximum amount of horizontal detail we can put into the picture.

Applying the circle rule, 330 of the dots fit across the largest circle that in turn fits in the screen, thus giving the commonly published horizontal resolution of 330 lines for NTSC broadcast TV programs. While the TV set may be capable of higher resolution (making even smaller sized dots as needed for the best playback of DVD) the most resolution that will be seen for received TV broadcasts is 330 lines.

Trying to broadcast more dots on a scan line would make parts of the video signal go above 4.2 MHz and interfere with the sound portion of the TV channel which is positioned at 4.5 MHz. The circuits (filters) that make sure the video signal does not contaminate the audio signal unfortunately usually weaken the portion of the valid video signal near 4.2 MHz. This makes it impossible to get the tiniest details that could be broadcast to be really black or white; they end up being dark gray and light gray instead.

Technical term: Bandwidth -- The difference between the maximum and the minimum frequencies of a band of frequencies that a circuit or system can pass with no more than 50% attenuation (weakening). If the bandwidth does not start at zero, two of the parameters lower bound, upper bound, and width, must be specified.

Some sources state that 4.0 MHz is the maximum usable video frequency, since typical video amplifiers in the early days couldn't get up to 4.2 MHz while still cutting off by 4.5 MHz. This permits an even 8 million dots per second or 508 dots per scan line. Also, if the transmitting electronics weakened the 4.2 MHz portions of the video signal by 50% and the receiving electronics weakened it another 50%, each set of electronics by itself meeting the definition of a 4.2 MHz bandwidth, by the time the picture got to the screen, the tiniest dots could still be too much grayed out to be distinguished.

* Numbers marked with an asterisk are approximate. These numbers and also the exact location of the 525'th line may vary slightly depending on the subject matter and with the make and model of equipment used.

+ To make this text clearer, numbers marked with a plus sign have been rounded from actual precise values that have lots of decimal places.

For NTSC interlaced video, the horizontal resolution is 80 (79) times the video circuitry bandwidth in megahertz, for example 3.0 MHz which is typical for a cheap TV allows about 240 lines of resolution.

APPENDIX B – Detailed descriptions White Balance

Parts of this Appendix are taken from the web site

http://www.photoxels.com/tutorial_white-balance.html

If you come from the world of films or single lens reflex cameras, you may remember using filters to correct for incandescent or fluorescent lighting. Most people don't bother and their indoors pictures invariably come out with a yellow/orange or bluish cast. In the digital world, these correction filters are no longer necessary, replaced by a feature found in most -- even the entry-level -- digital cameras called, "White Balance."

Light Color Temperature

The reason that pictures turn out with a yellow/orange cast in incandescent (tungsten) lighting and bluish in fluorescent lighting is because light has a color temperature. A low color temperature shifts light toward the red; a high color temperature shifts light toward the blue. Different light sources emit light at different color temperatures, and thus the color cast.

By using an orange or blue filter, we absorb the orange and blue light to correct for the "imbalance" -- the net effect is a shift in the color temperature.

Manual White Balance

This is where the concept of "White Balance" comes in. If we can tell the camera which object in the room is white and supposed to come out white in the picture, the camera can calculate the difference between the current color temperature of that object and the correct color temperature of a white object. And then shift all colors by that difference.

Most advanced digital cameras provide the feature to manually set the white balance. By pointing the camera at a white or gray card (angled so that it is reflecting light from the room) as a neutral reference, filling the screen completely with it, then pressing the White Balance button (or set it in the menu), the camera does its White Balance calculation.

From then on, any picture taken will have its color temperature shifted appropriately.

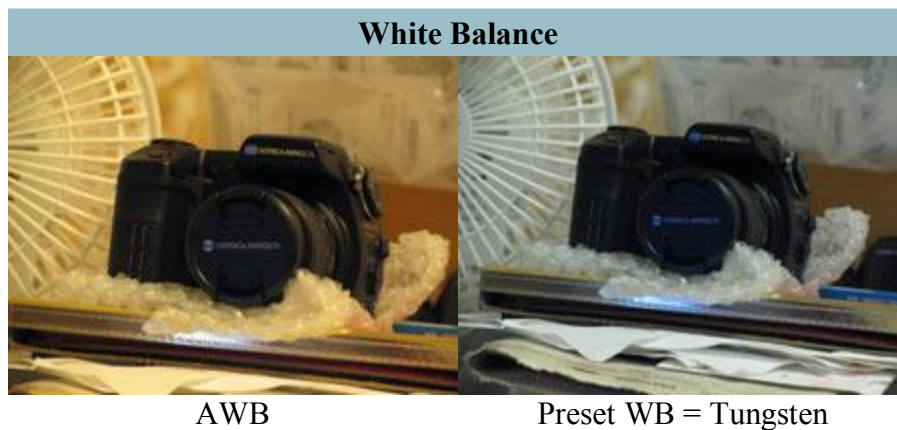
A sophisticated user of a Ken-A-Vision camera, might try placing a white card in front of the camera just before taking an image, and the camera will undergo self white balance under the extant lights, or in those cameras with manual re-setting of white balance, the color temperature can be adjusted for.

Automatic and Manual Re-setting White Balance

All Ken-A-Vision cameras provide a preset White Balance setting which works well in most lighting situations including Tungsten, Fluorescent, Cloudy, Sunny, etc.

Some Ken-A-Vision cameras also allow the user to adjust the White Balance using the *Applied Vision* Software. This is accessed by clicking on the three tools icon (on the live image screen), then within the 'Video' box that appears, click on the camera icon in left corner of box. The tab which will give the user access to the White Balance button varies among different cameras. Note in *Applied Vision 3* (coming in spring 2007) the image will remain on screen so that changes in settings can be seen as adjustments are made.

Note – Manual re-set is not available on all KAV cameras – It is available on the camera drives used in the 7200UM, 7890U, 7890UM, , T-1252, T-1754, T-1952, T-1954, , 1401 KRM/KEM.



In the above example, the picture on the left is taken with the camera set to Auto White Balance. The indoor lighting is by two ordinary incandescent (tungsten) bulbs from the ceiling. It's not bad, but the fan should really be white. By adjusting the White Balance, the color temperature can be adjusted for by most users.

Usually the preset White Balance setting is appropriate for most lighting situations.

Additional ways to make Color Temperature adjustments

When you save an image on a Ken-A-Vision camera, you are saving it the way the image sensor sees it after pre-set white balancing has occurred. With single images, Ken-A-Vision cameras default to a JPEG format, to which after the picture is taken, the brightness, contrast and color intensity can be corrected within limits using the buttons on the palette. Undo your change and try again, ad infinitum, in as fine an increment as you wish, until you obtain perfect color balance. The image may also be exported to any software that allows manipulation of the image, and even more severe brightness, contrast, and color changes may be made.